

# METAL PROGRESS

## Subject Index

Vol. 97, January 1970 through June 1970

### Aerospace

Aluminum-Boron Composites for Aerospace Structures, by J. L. Christian, H. D. Forest, and M. D. Weisinger .. 5-113

Materials Challenges in Future Space Programs, by Lawrence J. Korb and L. K. Crockett ..... 3-99

### Aircraft

Cost Factors Affecting Titanium Forming, by C. C. Lacy and A. T. Taylor ..... 3-76

Creep Forming Is a Production Process, by Louis E. Frost ..... 3-86

Evaluating Paint Systems for Aircraft, by M. C. Miyaji and W. M. Sutherland ..... 6-101

How GE Is Bridging the Processability Gap ... Coatings Lengthen Jet Engine Life, by Frank J. Hermanek Jr. .... 3-104

How GE Is Bridging the Processability Gap ... Dip Brazing 7005 Aluminum Fan Vanes, by E. C. Helder and J. F. Rudy ..... 3-110

How GE Is Bridging the Processability Gap ... An ECM Process for Drilling Deep Holes, by Cletis Jackson ..... 3-106

How GE Is Bridging the Processability Gap ... Electrolyte Control in Electrochemical Machining, by T. M. Mercer ..... 3-136

Materials Systems in Action ... The Pratt & Whitney Gas Turbine Story, Elihu F. Bradley, D.G. Phinney, and Matthew J. Donachie Jr. .... 3-68

Materials Technology for Borsic-Aluminum Aircraft Parts, by Kenneth G. Kreider and Edward M. Breinan ..... 5-104

Solving Problems in Making the 'Biggest Bird,' by J.E. Gilmer ..... 3-81

### Alloy steels

Cooling Transformation Diagram for AISI O1 Tool Steel ..... 2-72

How Grain Size and Cooling Rate Affect AISI 8620, by Clements F. zurLippe and John D. Grozier ..... 1-94

### Aluminum alloys

Aluminum-Boron Composites for Aerospace Structures, by J. L. Christian, H. D. Forest, and M. D. Weisinger .. 5-113

Guide for Selecting Filler Metals for Heat-Treatable Aluminum Alloys .... 3-94

Guide for Selecting Filler Metals for Nonheat-Treatable Aluminum Alloys .... 3-93

How GE Is Bridging the Processability Gap ... Dip Brazing 7005 Aluminum Fan Vanes, by E. C. Helder and J. F. Rudy ..... 3-110

Materials Technology for Borsic-Aluminum Aircraft Parts, by Kenneth G. Kreider and Edward M. Breinan ..... 5-104

Process Factors Affecting Finish of Aluminum Alloy Extrusions, by Edmund C. Franz ..... 6-80

Where Aluminum Extrusion Tooling Stands, by Dennis D. Huffman ..... 4-107

### Annealing

Radiant-Wall Furnace Anneals Stainless Sheet Vertically ..... 5-139

### Appliances

The Westinghouse Refrigerator Story, by Fred L. Siegrist ..... 5-69

### Automation

What Automation Can Do ... in Arc Welding ..... 2-67

What Automation Can Do ... in Brazing, by Donald C. Dilley ..... 2-92

What Automation Can Do ... in Contour Milling, by Richard A. Mathias ..... 2-65

What Automation Can Do ... in Electroplating, by James R. Kirkhoff ... 2-84

What Automation Can Do ... in the Foundry, by W. I. Koskella ..... 2-119

What Automation Can Do ... in Induction Heating, by Jack T. Temin .... 2-63

What Automation Can Do ... in Furnace Heat Treating, by Albert T. Enk ..... 2-59

What Automation Can Do ... in Metal Stamping, by George Crook ..... 2-82

What Automation Can Do ... Need for a Management Philosophy, by Roger W. Bolz ..... 2-54

What Automation Can Do ... in Non-destructive Testing, by Robert G. Strother ..... 2-87

What Automation Can Do ... in Punching Operations, by James A. Good .. 2-79

What Automation Can Do ... with Industrial Robots, by Jule Harrah .... 2-127

What You Can Do With Automatic Fluxing, by Joseph Bruno Celkupa .... 2-93

What You Can Do With Automatically Fed Wire, by Charles M. Norlin .... 2-94

What You Can Do With ConveyORIZED Aluminum Brazing, by Charles H. Busch ..... 2-106

What You Can Do With Hot Gas Brazing, by Harry E. Miller ..... 2-102

What You Can Do With Paste Filler Metals, by Bruce R. Williams ..... 2-98

### Brazing

How GE Is Bridging the Processability Gap ... Dip Brazing 7005 Aluminum Fan Vanes, by E. C. Helder and J. F. Rudy ..... 3-110

What Automation Can Do ... in Brazing, by Donald C. Dilley ..... 2-92

What You Can Do With Automatic Fluxing, by Joseph Bruno Celkupa ..... 2-93

What You Can Do With Automatically Fed Wire, by Charles M. Norlin .... 2-94

What You Can Do With ConveyORIZED Aluminum Brazing, by Charles H. Busch ..... 2-106

What You Can Do With Hot Gas Brazing, by Harry E. Miller ..... 2-102

What You Can Do With Paste Filler Metals, by Bruce R. Williams ..... 2-98

### Carburizing

Another Look at High-Temperature Carburizing, by Norman O. Kates ..... 1-90

### Carbide tools

Small Hardness Variations Affect Cemented Carbide Tool Life, by Abraham Ber and E.E. J. Weller ..... 4-139

Tooling Technology in the 1970's ... Carbide Tools Ease Cold Extrusion, by W. L. Kennicott ..... 4-78

Tooling Technology in the 1970's ... Cemented Titanium Carbide Has Big Future, by Herbert S. Kalish ..... 4-82

Tooling Technology in the 1970's ... Machinable Carbides Solve Problems, by Stuart E. Tarkan ..... 4-76

Tooling Technology in the 1970's ... Titanium Carbide Coating Raises Wear Resistance of Inserts, by Gerhard Persson ..... 4-87

### Cast iron

How Fiat Makes and Uses Castings, by Sergio Gallo ..... 5-141

### Ceramic tools

Tooling Technology in the 1970's ... Ceramic Inserts Expedite Machining, Staff Report ..... 4-84

### Cemented carbides

Small Hardness Variations Affect Cemented Carbide Tool Life, by Abraham Ber and E. J. Weller ..... 4-139

Tooling Technology in the 1970's ... Cemented Titanium Carbide Has Big Future, by Herbert S. Kalish ..... 4-82

### Characterization

Materials Systems: A Character Analysis, by William M. Duke ..... 1-80

### Cold extrusion

Cold Extruding Steel, by Donald J. Blickwede ..... 5-76

### Composite materials

Aluminum-Boron Composites for Aerospace Structures, by H. L. Christian, J. D. Forest, and M. D. Weisinger .. 5-113

Materials Technology for Borsic-Aluminum Aircraft Parts, by Kenneth G. Kreider and Edward M. Breinan .... 5-104

### Cooling curves

Cooling Transformation Diagram for AISI O1 Tool Steel ..... 2-72

How Grain Size and Cooling Rate Affect AISI 8620, by Clements F. zurLippe and John D. Grozier ..... 1-94

### Cost analysis

Bridging the Processability Gap ... Cost Factors Affecting Titanium Forming, by C. C. Lacy and A. T. Taylor ..... 3-76

## Creep forming

- Bridging the Processability Gap . . .  
Creep Forming Is a Production Process, by Louis E. Frost . . . 3-86
- Tooling Technology in the 1970's . . .  
A Die Material for Creep-Forming Titanium, by J. Barry Hartland and R. William Breitig . . . 4-135

## Die castings

- Case for Vibratory Finishing of Zinc Die Castings, by William H. Safranek and Hugh R. Miller . . . 6-88
- Compositions and Properties of Die Casting Alloys . . . 6-93
- Tooling Technology in the 1970's . . .  
Maraging Steels for Die Casting, by Alexander Nagy . . . 4-70

## Dies

- Tooling Technology in the 1970's . . .  
Why Tools and Die Fail, by John Y. Riedel . . . 4-101

## Dip brazing

- How GE Is Bridging the Processability Gap . . . Dip Brazing 7005 Aluminum Fan Vanes, by E. C. Helder and J. F. Rudy . . . 3-110

## Editorial

- Architect of Tomorrow's Products, by Allen G. Gray . . . 1-79
- Bridging the Processability Gap, by Allen G. Gray . . . 3-67
- Design Opportunities With Materials, by Allen G. Gray . . . 5-67
- Finishing Technology Meets Today's Challenges, by Allen G. Gray . . . 6-65
- The Materials Engineer's Stake in Conservation, by Allen G. Gray . . . 4-67
- Where Improvements Will Come From, by Allen G. Gray . . . 2-53

## Electrochemical machining

- How GE Is Bridging the Processability Gap . . . An ECM Process for Drilling Deep Holes, by Cletis Jackson . . . 3-106
- How GE Is Bridging the Processability Gap . . . Electrolyte Control in Electrochemical Machining, by T. M. Mercer . . . 3-136

## Electron-beam refining

- What Users of Stainless Steel Can Do About the Nickel Shortage . . . E-B Refining Upgrades 26Cr-1Mo Stainless, by Eric Gregory and Roy J. Knott . . . 1-114

## Electropainting

- Electropainting . . . The 'Near Perfect' Method, by H. L. Stein . . . 6-75

## Electroplating

- Cyanide Zinc Plating Today, by Robert R. Bair . . . 6-72
- Selecting Electroplated Metals, by Leo Missel . . . 6-110
- Standards for Plating on Plastics, Staff Report . . . 6-83
- Stretching Nickel in Electroplating and Alternate Finishes, Staff Report . . . 6-66
- What Automation Can Do . . . in Electroplating, by James R. Kirkhoff . . . 2-84

## Extrusion

- Cold Extruding Steel, by Donald J. Blickwede . . . 5-76
- Process Factors Affecting Finish of Aluminum Alloy Extrusions, by Edmund C. Franz . . . 6-80
- Tooling Technology in the 1970's . . .  
Where Aluminum Extrusion Tooling Stands, by Dennis D. Huffman . . . 4-107

## Failure

- How Cracks Grow in Structural Steels, by William G. Clark Jr. . . . 5-81
- Tooling Technology in the 1970's . . .  
Why Tools and Dies Fail, by John Y. Riedel . . . 4-101

## Fasteners

- Fastener Simplification at Ford, by Ralph E. Vandeventer . . . 5-99

## Finishing

- Case for Vibratory Finishing of Zinc Die Castings, by William H. Safranek and Hugh R. Miller . . . 6-88

- Curing Paint With Electron Beams, Staff Report . . . 6-86
- Cyanide Zinc Plating Today, by Robert R. Bair . . . 6-72
- Electropainting . . . The 'Near Perfect' Method, by H. L. Stein . . . 6-75
- Evaluating Paint Systems for Aircraft, by M. C. Miyaji and W. M. Sutherland . . . 6-101
- How GE Is Bridging the Processability Gap . . . Coatings Lengthen Jet Engine Life, by Frank J. Hermanek Jr. . . 3-104
- Practical Finishes for Magnesium, by H. K. DeLong . . . 6-105
- Process Factors Affecting Finish of Aluminum Alloy Extrusions, by Edmund C. Franz . . . 6-80
- Selecting Electroplated Metals, by Leo Missel . . . 6-110
- Stretching Nickel in Electroplating and Alternate Finishes, Staff Report . . . 6-66
- What to Consider in Specifying Zinc Coatings, by Ernest W. Horvick . . . 6-124

## Forging

- Assuring Quality in a King-Sized Forging, by Fred L. Siegrist . . . 4-105

## Forming

- Bridging the Processability Gap . . .  
Creep Forming Is a Production Process, by Louis E. Frost . . . 3-86
- Tooling Technology in the 1970's . . .  
A Die Material for Creep-Forming Titanium, by J. Barry Hartland and R. William Breitig . . . 4-135
- What Automation Can Do . . . in Metal Stamping, by George Crook . . . 2-82
- What Automation Can Do . . . in Punching Operations, by James A. Good . . . 2-79

## Galvanizing

- New Knowledge About Sheet Steel . . .  
How Galvanizing Affects Structure and Properties, by Donald J. Blickwede . . . 1-86

## Gas turbines

- How GE Is Bridging the Processability Gap . . . Coatings Lengthen Jet Engine Life, by Frank J. Hermanek Jr. . . 3-104
- How GE Is Bridging the Processability Gap . . . An ECM Process for Drilling Deep Holes, by Cletis Jackson . . . 3-106
- How GE Is Bridging the Processability Gap . . . Electrolyte Control in Electrochemical Machining, by T. M. Mercer . . . 3-136
- Materials Systems in Action . . . The Pratt & Whitney Gas Turbine Story, Elihu F. Bradley, D. G. Phinney, and Matthew J. Donachie Jr. . . . 3-68

## Heat treatment

- Another Look at High-Temperature Carburizing, by Norman O. Kates . . . 1-90
- Convenience, Economy Characterize Versatile Quenchant, by Anthony A. Wolinski . . . 4-123
- Guide for Selecting Filler Metals for Heat-Treatable Aluminum Alloys . . . 3-93
- Guide for Selecting Filler Metals for Nonheat-Treatable Aluminum Alloys . . . 3-93
- Heat Treating Tool Steels, Staff Report . . . 4-89
- Typical Heat Treatment and Characteristics of AISI Tool Steels . . . 4-92
- What Automation Can Do . . . in Furnace Heat Treating, by Albert T. Enk . . . 2-59
- What Automation Can Do . . . in Induction Heating, by Jack T. Temin . . . 2-63

## Heat-resistant alloys

- Tooling Technology in the 1970's . . .  
Superalloys for Supertools, by E. J. Lane . . . 4-68

## High-speed tool steels

- Tooling Technology in the 1970's . . .  
AISI M47: An Economical High-Speed Steel With Extra Hardness, by Paul R. Borneman . . . 4-88
- Tooling Technology in the 1970's . . .  
Matrix Grades Offer Strength, Toughness, by Alan M. Bayer . . . 4-86
- Tooling Technology in the 1970's . . .  
An Ultrahard Steel for Machining Jet Age Materials, by Harry H. Cornell . . . 4-83

## Induction heating

- What Automation Can Do . . . in Induction Heating, by Jack T. Temin . . . 2-63

## Induction sintering

- Induction Sintering Has Potential for Powder Metal Parts, by Joel S. Hirschhorn, Manohar Samat, and George M. Maxwell . . . 5-135

## Joining

- Bridging the Processability Gap . . .  
Solving Problems in Making the 'Biggest Bird', by J. E. Gilmer . . . 3-81
- Fastener Simplification at Ford, by Ralph E. Vandeventer . . . 5-99

## Machining

- How GE Is Bridging the Processability Gap . . . An ECM Process for Drilling Deep Holes, by Cletis Jackson . . . 3-106
- How GE Is Bridging the Processability Gap . . . Electrolyte Control in Electrochemical Machining, by T. M. Mercer . . . 3-136

## Magnesium alloys

- Practical Finishes for Magnesium, by H. K. DeLong . . . 6-105

## Maraging steels

- Tooling Technology in the 1970's . . .  
Maraging Steels for Die Casting, by Alexander Nagy . . . 4-70

## Materials systems

- Materials Systems: A Character Analysis, by William M. Duke . . . 1-80
- Materials Systems in Action . . . The Pratt & Whitney Gas Turbine Story, Elihu F. Bradley, D. G. Phinney, and Matthew J. Donachie Jr. . . . 3-68
- The Westinghouse Refrigerator Story, by Fred L. Siegrist . . . 5-69

## Milling

- What Automation Can Do . . . in Con-tour Milling, by Richard A. Mathias . . . 2-65

## Nickel plating

- Stretching Nickel in Electroplating and Alternate Finishes, Staff Report . . . 6-66

## Nickel shortage

- Stretching Nickel in Electroplating and Alternate Finishes, Staff Report . . . 6-66
- What Users of Stainless Steel Can Do About the Nickel Shortage . . .  
E-B Refining Upgrades 26Cr-1Mo Stainless, by Eric Gregory and Roy J. Knott . . . 1-114
- Plastic-Lined Steel Pipe for the Process Industries, by L. W. Gleekman and J. M. Ayres . . . 1-122
- Where to Consider the 200 and 400 Grades, by Robert H. Kaltenhauser . . . 1-99
- Where to Consider the Straight-Chromium Grades, by Frank M. Richmond . . . 1-103

## Nondestructive testing

- What Automation Can Do . . . in Nondestructive Testing, by Robert G. Strother . . . 2-87

## Painting

- Bridging the Processability Gap . . .  
Solving Problems in Making the 'Biggest Bird', by J. E. Gilmer . . . 3-81
- Curing Paint With Electron Beams, Staff Report . . . 6-86
- Electropainting . . . The 'Near Perfect' Method, by H. L. Stein . . . 6-75
- Evaluating Paint Systems for Aircraft, by M. C. Miyaji and W. M. Sutherland . . . 6-101

## Pipe

- What Users of Stainless Steel Can Do About the Nickel Shortage . . . Plastic-Lined Steel Pipe for the Process Industries, by L. W. Gleekman and J. M. Ayres . . . 1-122

## Plastics

- Mechanical and Physical Properties of Engineering Plastics . . . 5-88
- Standards for Plating on Plastics, Staff Report . . . 6-83
- Tooling Technology in the 1970's . . .  
Carvable Plastics for Models, Patterns, by Richard B. Peterson . . . 4-72
- Tooling Technology in the 1970's . . .  
Where Urethanes Are Used in the Foundry, by James Kosmala . . . 4-83

What Users of Stainless Steel Can Do About the Nickel Shortage . . . Plastic-Lined Steel Pipe for the Process Industries, by L. W. Gleekman and J. M. Ayres . . . 1-122

#### Powder metal parts

Induction Sintering Has Potential for Powder Metal Parts, by Joel S. Hirschhorn, Manohar Samat, and George M. Maxwell . . . 5-135

#### Punching

What Automation Can Do . . . in Punching Operations, by James A. Good . . 2-79

#### Quenching media

Convenience, Economy Characterize Versatile Quenchant, by Anthony A. Wolinski . . . 4-123

#### Sheet

New Knowledge About Sheet Steel . . . How Galvanizing Affects Structure and Properties, by Donald J. Blickwede . . . 1-86

#### Sintering

Induction Sintering Has Potential for Powder Metal Parts, by Joel S. Hirschhorn, Manohar Samat, and George M. Maxwell . . . 5-135

#### Spring

Ultrahigh-Strength Stainless for Light-Gage Spring Applications, by Seth R. Thomas and Eric C. Sharpless . . . 5-131

#### Stainless steels

Radiant-Wall Furnace Anneals Stainless Sheet Vertically . . . 5-139

Tooling Technology in the 1970's . . . A Stainless Grade for Plastic Molds, by William Young . . . 4-71

Ultrahigh-Strength Stainless for Light-Gage Spring Applications, by Seth R. Thomas and Eric C. Sharpless . . . 5-131

What Users of Stainless Steel Can Do About the Nickel Shortage . . .

E-B Refining Upgrades 26Cr-1Mo Stainless, by Eric Gregory and Roy J. Knott . . . 1-114

Plastic-Lined Steel Pipe for the Process Industries, by L. W. Gleekman and J. M. Ayres . . .

Where to Consider the 200 and 400 Grades, by Robert H. Kaltenhauser . . . 1-99

Where to Consider the Straight-Chromium Grades, by Frank M. Richmond . . . 1-103

Stamping

What Automation Can Do . . . in Metal Stamping, by George Crook . . . 2-82

#### Standards

Standards for Plating on Plastics, Staff Report . . . 6-83

#### Steels

Cold Extruding Steel, by Donald J. Blickwede . . . 5-76

How Cracks Grow in Structural Steels, by William G. Clark Jr. . . . 5-81

New Knowledge about Sheet Steel . . . How Galvanizing Affects Structure and Properties, by Donald J. Blickwede . . . 1-86

Tooling Technology in the 1970's . . . Maraging Steels for Die Casting, by Alexander Nagy . . . 4-70

Tooling Technology in the 1970's . . . Matrix Grades Offer Strength, Toughness, by Alan M. Bayer . . . 4-86

What Users of Stainless Steel Can Do About the Nickel Shortage . . . Plastic-Lined Steel Pipe for the Process Industries, by L. W. Gleekman and J. M. Ayres . . . 1-122

#### Structural steels

How Cracks Grow in Structural Steels, by William G. Clark Jr. . . . 5-81

#### Technology Forecast

Technology Forecast: Surveying the 70's . . . 1-18

#### Titanium

Bridging the Processability Gap . . . Cost Factors Affecting Titanium Forming, by C. C. Lacy and A. T. Taylor . . 3-76

#### Tooling

A Die Material for Creep-Forming Titanium, by J. Barry Hartland and R. William Breitzig . . . 4-135

Heat Treating Tool Steels, Staff Report . . . 4-89

Small Hardness Variations Affect Cemented Carbide Tool Life, by Abraham Ber and E. J. Weller . . . 4-139

Tooling Technology in the 1970's . . . AISI M47: An Economical High-Speed Steel With Extra Hardness, by Paul B. Borneman . . . 4-88

Carbide Tools Ease Cold Extrusion, by W. L. Kennicott . . . 4-78

Carvable Plastics for Models, Patterns, by Richard B. Peterson . . . 4-72

Cemented Titanium Carbide Has Big Future, by Herbert S. Kalish . . . 4-82

Ceramic Inserts Expedite Machining, Staff Report . . . 4-84

Die Blocks of Forged H13 Are Tough, by Arne Omsen and Bengt E. Skoog . . . 4-75

Graphite Tool Steel for Precision Parts, by Philip A. Nagy . . . 4-80

Machinable Carbides Solve Problems, by Stuart E. Tarkan . . . 4-76

Maraging Steels for Die Casting, by Alexander Nagy . . . 4-70

Matrix Grades Offer Strength, Toughness, by Alan M. Bayer . . . 4-86

New Developments Boost Popularity of S7, by James J. McCarthy . . 4-74

P20: A Familiar Grade Updated for Molders, by E. E. Lull . . . 4-79

A Stainless Grade for Plastic Molds, by William Young . . . 4-71

Superalloys for Supertools, by E. J. Lane . . . 4-68

Titanium Carbide Coating Raises Wear Resistance of Inserts, by Gerhard Persson . . . 4-87

An Ultrahard Steel for Machining Jet Age Materials, by Harry H. Cornell . . . 4-83

Where Urethanes Are Used in the Foundry, by James Kosmala . . . 4-83

Typical Heat Treatment and Characteristics of AISI Tool Steels . . . 4-92

Where Aluminum Extrusion Tooling Stands, by Dennis D. Huffman . . . 4-107

Why Tools and Dies Fail, by John Y. Riedel . . . 4-101

Tool steels

Heat Treating Tool Steels, Staff Report . . . 4-89

Tooling Technology in the 1970's . . . Die Blocks of Forged H13 Are Tough, by Arne Omsen and Bengt E. Skoog . . . 4-75

Graphite Tool Steel for Precision Parts, by Philip A. Nagy . . . 4-80

Matrix Grades Offer Strength, Toughness, by Alan M. Bayer . . . 4-86

New Developments Boost Popularity of S7, by James J. McCarthy . . 4-74

P20: A Familiar Grade Updated for Molders, by E. E. Lull . . . 4-79

An Ultrahard Steel for Machining Jet Age Materials, by Harry H. Cornell . . . 4-83

Typical Heat Treatment and Characteristics of AISI Tool Steels . . . 4-92

Vibratory finishing

Case for Vibratory Finishing of Zinc Die Castings, by William H. Safranek and Hugh R. Miller . . . 6-88

Welding

Bridging the Processability Gap . . . Solving Problems in Making the 'Biggest Bird', by J. E. Gilmer . . . 3-81

What Automation Can Do . . . in Arc Welding . . . 2-67

Zinc plating

Cyanide Zinc Plating Today, by Robert R. Bair . . . 6-72

What to Consider in Specifying Zinc Coatings, by Ernest W. Horvick . . . 6-124

## AUTHOR INDEX

Ayres, J. M. . . . 1-122  
Bair, Robert R. . . . 6-72  
Bayer, Alan M. . . . 4-86  
Ber, Abraham . . . 4-139  
Blickwede, Donald J. . . 1-86;  
Bolz, Roger W. . . . 2-54  
Borneman, Paul R. . . . 4-88  
Bradley, Elihu F. . . . 3-68  
Breinan, Edward M. . . . 5-104  
Breitzig, R. William . . . 4-135  
Busch, Charles H. . . . 2-106  
Celkupa, Joseph Bruno . . 2-3  
Christian, J. L. . . . 5-113  
Clark, William G. Jr. . . . 5-81  
Cornell, Harry H. . . . 4-83  
Crockett, L. K. . . . 3-99  
Crook, George . . . . 2-82  
DeLong, H. K. . . . . 6-105  
Dille, Donald D. . . . 2-92  
Donachie, Matthew J. Jr. . 3-68  
Duke, William M. . . . 1-80  
Enk, Albert T. . . . . 2-59  
Forest, J. D. . . . . 5-113  
Franz, Edmund C. . . . 6-80  
Frost, Louis E. . . . . 3-86  
Gallo, Sergio . . . . 5-141  
Gilmer, J. E. . . . . 3-81  
Gleekman, L. W. . . . . 1-122  
Good, James A. . . . . 2-79  
Gray, Allen G. . . . 1-79; 2-53;  
4-67; 5-67; 6-65

Gregory, Eric . . . . 1-114  
Grozier, John W. . . . 1-94  
Harrah, Jule . . . . 2-127  
Hartland, J. Barry . . . 4-135  
Helder, E. C. . . . . 3-110  
Hermanek, Frank J. Jr. . . 3-104  
Hirschhorn, Joel S. . . . 5-135  
Horvick, Ernest W. . . . 6-125  
Huffman, Dennis D. . . . 4-107  
Jackson, Cletis . . . . 3-106  
Kalish, Herbert S. . . . 4-82  
Kaltenhauser, Robert H. . . 1-99  
Kates, Norman O. . . . 1-90  
Kennicott, W. L. . . . 4-78  
Kirkhoff, James R. . . . 2-84  
Knott, Roy J. . . . . 1-114  
Korb, Lawrence J. . . . 3-99  
Koskella, W. I. . . . . 2-119  
Kosmala, James . . . . 4-83  
Kreider, Kenneth G. . . . 5-104  
Lacy, C. C. . . . . 3-76  
Lane, E. J. . . . . 4-68  
Lull, E. E. . . . . 4-79  
Mathias, Richard A. . . . 2-65  
Maxwell, George M. . . . 5-135  
McCarthy, James J. . . . 4-74  
Mercer, T. M. . . . . 3-136  
Miller, Harry M. . . . . 2-102  
Miller, Hugh R. . . . . 6-88  
Missel, Leo . . . . 6-110

Miyaji, M. C. . . . . 6-101  
Nagy, Alexander . . . . 4-70  
Nagy, Philip A. . . . . 4-80  
Norlin, Charles M. . . . 2-94  
Omsen, Arne . . . . 4-75  
Persson, Gerhard . . . . 4-87  
Peterson, Richard B. . . . 4-72  
Phinney, D. G. . . . . 3-68  
Richmond, Frank M. . . . 1-103  
Riedel, John Y. . . . . 4-100  
Rudy, J. F. . . . . 3-110  
Safranek, William H. . . . 6-88  
Samat, Manohar . . . . 5-135  
Sharpless, Eric C. . . . 5-131  
Siegrist, Fred L. . . . 4-105; 5-69  
Skoog, Bengt E. . . . 4-75  
Stein, H. L. . . . . 6-75  
Strother, Robert G. . . . 2-87  
Sutherland, W. M. . . . 6-101  
Tarkan, Stuart E. . . . 4-76  
Taylor, A. T. . . . . 3-76  
Temin, Jack T. . . . . 2-63  
Thomas, Seth R. . . . . 5-131  
VanDeventer, Ralph E. . . 5-99  
Weisinger, M. D. . . . 5-113  
Weller, E. J. . . . . 4-139  
Williams, Bruce R. . . . 2-98  
Wolinski, Anthony A. . . . 4-123  
Young, William . . . . 4-71  
zurLippe, Clements F. . . 1-94



# METAL PROGRESS

## Subject Index

Vol. 98, July 1970 through December 1970

### Alloy steels

Annealing Aids Machinability of AISI 4140, by Ford C. Brandon ..... 1-103

### Aluminum alloys

Aluminum Alloys in the 70's (Round Table) .. 3-68

Casting the Vega Block at Massena, by Donald F. Baxter Jr. .... 4-168

Eddy Currents Check Aluminum Strip, by James J. Regan and Ron J. Botsco ..... 5-113

Practices and Equipment for Heat Treating Aluminum Alloys, by David S. Thompson, Ogle R. Singleton, Robert D. McGowan, and Grant E. Spangler ..... 3-78

Properties, Characteristics, and Applications of Heat-Treatable Aluminum Alloys (data sheet) ..... 3-86

### Aluminum oxide

Engineering With High-Alumina Ceramics, by Lawrence E. Ferreira, Daniel D. Briggs, and Ronald G. Barnhart ..... 6-78

Thermal, Mechanical, and Electrical Properties of Typical High-Alumina Ceramics (data sheet) ..... 6-85

### Annealing

Annealing Aids Machinability of AISI 4140, by Ford C. Brandon ..... 1-103

### Appliances

Nonmetallic Application Trends in Refrigerators, by Fred L. Siegrist ..... 1-115

### Automobiles

Casting the Vega Block at Massena, by Donald F. Baxter Jr. .... 4-168

Determining Wear of Tappets and Cams at Volkswagen, by Erwin Just ..... 2-110

Gear Rolling at Livonia, by Carl R. Weymueller ..... 4-175

Plastic Partsmaking at Saline, by Fred L. Siegrist ..... 4-153

Testing Automobile Components on Production Lines, by Carl R. Weymueller ..... 2-72

Tooling Alloys for Automotive Dies, by Ferdinand L. Ewald ..... 5-67

### Axles

Total Approach to Reliability of Case-Hardened Parts, by Stanislaw Mocarski ..... 3-96

### Batch carburizing

Batch Carburizing at Ft. Wayne, by William C. Hiatt and James P. Crosbie ..... 4-143

### Bend radius

Calculating Minimum Bend Radii From Ductility Rating, by Charles T. Yang ..... 5-107

### Brittleness

Avoiding Brittle Fractures in Cold-Formed ASTM 515 Steel, by Oscar W. Albritton .. 3-115

### Carburizing

Batch Carburizing at Ft. Wayne, by William C. Hiatt and James P. Crosbie ..... 4-143

### Case hardening

Total Approach to Reliability of Case-Hardened Parts, by Stanislaw Mocarski ..... 3-96

### Ceramics

Engineering With High-Alumina Ceramics, by Lawrence E. Ferreira, Daniel D. Briggs, and Ronald G. Barnhart ..... 6-78

Thermal, Mechanical, and Electrical Properties of Typical High-Alumina Ceramics (data sheet) ..... 6-85

### Casting

Casting the Vega Block at Massena, by Donald F. Baxter Jr. .... 4-168

### Copper

Properties and Applications of Wrought Coppers and Copper Alloys (data sheet) ..... 1-85

What's Ahead for Copper in the 70's (round table) ..... 1-73

### Copper alloys

Properties and Applications of Wrought Coppers and Copper Alloys (data sheet) ..... 1-85

What's Ahead for Copper in the 70's (round table) ..... 1-73

### Eddy current testing

Eddy Currents Check Aluminum Strip, by James J. Regan and Ron J. Botsco ..... 5-113

### Editorial

New Profit Opportunities, by Allen G. Gray .. 6-53

Partsmaking: Our Biggest Challenge, by Allen G. Gray ..... 4-117

Quality: Opportunity for Leadership, by Allen G. Gray ..... 2-71

Think Smarter Sooner, by Allen G. Gray .... 3-67

We Must Be Sure, by Allen G. Gray ..... 5-55

You and the Pollution Problem, by Allen G. Gray ..... 1-71

### Electron beam welding

Electron Beam Welder Has Nonvacuum Capability, Staff Report ..... 5-56

### Electronic devices

Soldering and Welding Electronic Joints, by Jerome W. Kaufman ..... 1-95

### Electroslag process

Continuous Electroslag Melting Process Turns Out a Variety of Steels, Staff Report .... 3-121

### Explosive bonding

Explosive Bonding Dissimilar Metals, by Thomas

J. Enright, William F. Sharp, and Oswald R. Bergmann ..... 1-107

### Fabrication

Survey Report: Processes for Today and Tomorrow ..... 4-127

### Failure

In Many Investigations, Standard Instruments Are Adequate, by C. Howard Craft ..... 5-79

Investigating an Aircraft Disaster, by Ralph D. Barer and Thomas S. Sterling ..... 5-84

Solving an Unusual Shaft Failure, by Jack J. Bodzin and Gordon W. Houser ..... 5-103

Why Gears Fail, by Lester E. Alban ..... 5-95

### Forging

Hot Forging at Portland, Staff Report ..... 4-150

### Fractography

Fractography Explains Failures in Soldered Joints, by David B. Martin and William R. Merwarth ..... 2-103

### Fracturing

Avoiding Brittle Fractures in Cold-Formed ASTM 515 Steel, by Oscar W. Albritton .. 3-115

### Friction welding

Inertia Welding at Mentor, Staff Report .... 4-160

### Gear rolling

Gear Rolling at Livonia, by Carl R. Weymueller ..... 4-175

### Gears

Total Approach to Reliability of Case-Hardened Parts, by Stanislaw Mocarski ..... 3-96

Why Gears Fail, by Lester E. Alban ..... 5-95

### Heat treatment

High Volume Key to Economic Property Control, Staff Report ..... 3-122

Practices and Equipment for Heat Treating Aluminum Alloys, by David S. Thompson, Ogle R. Singleton, Robert D. McGowan, and Grant E. Spangler ..... 3-78

Properties, Characteristics, and Applications of Heat-Treatable Aluminum Alloys (data sheet) 3-86

### Hot working

Hot Forging at Portland, Staff Report ..... 4-150

### Impact tests

Correlating European and American Impact Tests, by Joseph G. Dunleavy and Joseph W. Spretnak ..... 5-119

### Inertia welding

Inertia Welding at Mentor, Staff Report .... 4-160

## Low-temperature steels

- Choosing Steels for Low-Temperature Service,  
by E. Gary Marshall ..... 3-91

## Machinability

- Annealing Aids Machinability of AISI 4140, by  
Ford C. Brandon ..... 1-103  
Modification Adds Machinability to Type 303,  
by Curtis W. Kovach and Arthur Moskowitz ..... 1-105

## Materials selection

- Survey Report: Processes for Today and To-  
morrow ..... 4-127

## Materials systems

- Nonmetallic Application Trends in Refrigera-  
tors, by Fred L. Siegrist ..... 1-115

## Mechanical testing

- Correlating European and American Impact  
Tests, by Joseph G. Dunleavy and Joseph  
W. Sprtnak ..... 5-119  
Determining Wear of Tappets and Cams at  
Volkswagen, by Erwin Just ..... 2-110  
How Fatigue Affects Bolted Joints at High  
Temperatures, by Karl H. Beelich ..... 2-115  
Simulating Years of Truck Service in Weeks,  
by Carl R. Weymueller ..... 2-107

## Melting

- Continuous Electrosag Melting Process Turns  
Out a Variety of Steels, Staff Report ..... 3-121

## Metallographic exhibit

- Etch Pits Determine Fracture Planes in Beryl-  
lium Sheet ..... 6-96

## Metallography

- Basic Tool for the Materials and Process  
Engineer ..... 2-94  
Fractography Explains Failures in Soldered  
Joints, by David B. Martin and William R.  
Merwarth ..... 2-103  
Metallographic Reagents for Iron and Steel  
(data sheet) ..... 2-87

## Metal producing

- High Volume Key to Economic Property Con-  
trol, Staff Report ..... 3-122

## Neutron radiography

- Neutron Radiography Complements X-Ray, by  
Charles R. Wilson ..... 2-75

## Nitriding

- Nitriding Improves Fatigue Resistance of P/M  
Parts, Staff Report ..... 1-100

## Nondestructive testing

- Eddy Currents Check Aluminum Strip, by  
James J. Regan and Ron J. Botsco ..... 5-113  
Neutron Radiography Complements X-Ray, by  
Charles R. Wilson ..... 2-75  
Testing Automobile Components on Production Lines,  
by Carl Weymueller ..... 2-72

## Total Quality Approach for Pressure Vessels,

- Edward S. Proctor ..... 2-80

## Partsmaking

- How We Will Make Parts in the 70's (round  
table) ..... 4-118

## Plastics

- Nonmetallic Application Trends in Refrigera-  
tors, by Fred L. Siegrist ..... 1-115  
Plastic Partsmaking at Saline, by Fred L.  
Siegrist ..... 4-153

## Pollution control

- Control Considerations in Washing, Painting,  
and Soluble Oil Removal, by Chester R.  
Wiedemann ..... 6-66  
Disposal of Cyanide Heat Treating Wastes,  
by Gordon Vivian ..... 6-61  
Environmental Detection Systems, by Richard  
C. Carnes ..... 6-67  
High-Energy Wet Gas Cleaning for the Basic  
Oxygen OG Process, by Richard W. Adams  
Incinerators for the Metalworking Industry, by  
Thomas A. Blanchard ..... 6-57  
Recommendations for Dust Collection Systems,  
by Donald H. Taylor ..... 6-63  
Recovering Acid and Soluble Ferrous Sulfate  
From Waste Pickle Liquor, by R. J. Lackner  
Reverse Osmosis for Waste Water Treatment,  
by Gordon F. Leitner ..... 6-62  
Technology: the Key to Pollution Control,  
Staff Report ..... 6-54  
Three Ways to Minimize Water Pollution in  
Cleaning, Finishing, by Marshall A. Bland  
Water Conservation by Re-Use at Republic,  
by David G. Berkebile ..... 6-64

## Powder metallurgy parts

- Making P/M Parts at Gallipolis, by Harry  
E. Chandler ..... 4-140  
Nitriding Improves Fatigue Resistance of P/M  
Parts, Staff Report ..... 1-101

## Pressure vessels

- Total Quality Approach for Pressure Vessels,  
by Edward S. Proctor ..... 2-80

## Processing

- Survey Report: Processes for Today and To-  
morrow ..... 4-127

## Shafts, power

- Solving an Unusual Shaft Failure, by Jack J.  
Bodzin and Gordon W. Houser ..... 5-103

## Sheet

- How a Fabricator Views Strain Aging of Low-  
Carbon Sheet Steel, by M. Robert Baren and  
Paul G. Nelson ..... 6-87

## Soldering

- Fractography Explains Failures in Soldered  
Joints, by David B. Martin and William R.  
Merwarth ..... 2-103  
Soldering and Welding Electronic Joints, by  
Jerome W. Kaufman ..... 1-95

## Stainless steels

- An Austenitic Steel for High-Temperature Ser-  
vice Applications, by Lennart Egnell ..... 3-102  
Modification Adds Machinability to Type 303,  
by Curtis W. Kovach and Arthur Moskowitz ..... 1-105

## Steels

- An Austenitic Steel for High-Temperature  
Service Applications, by Lennart Egnell ..... 3-102  
Avoiding Brittle Fractures in Cold-Formed  
ASTM 515 Steel, by Oscar W. Albritton ..... 3-115  
Choosing the Right EX Steels, by Carl R. Wey-  
mueller ..... 4-130  
Choosing Steels for Low-Temperature Service,  
by E. Gary Marshall ..... 3-91  
The EX Steels and Equivalent Standard Grades  
(data sheet) ..... 4-137  
How a Fabricator Views Strain Aging of Low-  
Carbon Sheet Steel, by M. Robert Baren and  
Paul G. Nelson ..... 6-87

## Strain aging

- How a Fabricator Views Strain Aging of Low-  
Carbon Sheet Steel, by M. Robert Baren and  
Paul G. Nelson ..... 6-87

## Testing

- Basic Tool for the Materials and Process  
Engineer ..... 2-94  
Determining Wear of Tappets and Cams at  
Volkswagen, by Erwin Just ..... 2-110  
Eddy Currents Check Aluminum Strip, by James  
J. Regan and Ron J. Botsco ..... 5-113  
Fractography Explains Failures in Soldered  
Joints, by David B. Martin and William R.  
Merwarth ..... 2-103  
How Fatigue Affects Bolted Joints at High  
Temperatures, by Karl H. Beelich ..... 2-115  
Metallographic Reagents for Iron and Steel  
(data sheet) ..... 2-87  
Neutron Radiography Complements X-Ray, by  
Charles R. Wilson ..... 2-75  
Simulating Years of Truck Service in Weeks,  
by Carl R. Weymueller ..... 2-107  
Testing Automobile Components on Production  
Lines, by Carl R. Weymueller ..... 2-72  
Total Quality Approach for Pressure Vessels,  
by Edward S. Proctor ..... 2-80

## Tooling

- Tooling Alloys for Automotive Dies, by Ferd-  
inand L. Ewald ..... 5-67

## Tool steels

- Classification and Selection of Tool Steels  
(data sheet) ..... 5-73  
Tooling Alloys for Automotive Dies, by Ferd-  
inand L. Ewald ..... 5-67

## Trucks

- Simulating Years of Truck Service in Weeks,  
by Carl R. Weymueller ..... 2-107

## Welding

- Electron Beam Welder Has Nonvacuum Cap-  
ability, Staff Report ..... 5-56  
Inertia Welding at Mentor, Staff Report ..... 4-160  
Soldering and Welding Electronic Joints, by  
Jerome W. Kaufman ..... 1-95

# AUTHOR INDEX

- Adams, Richard W. .... 6-68  
Alban, Lester E. .... 5-95  
Albritton, Oscar W. .... 3-115  
Anderson, Leroy L. .... 4-119  
Baren, M. Robert ..... 6-87  
Barer, Ralph D. .... 5-84  
Barnhart, Ronald G. .... 6-78  
Baxter, Donald F., Jr. .... 4-168  
Beelich, Karl H. .... 2-115  
Bergmann, Oswald R. .... 1-107  
Berkebile, David G. .... 6-64  
Bladzki, Kenneth R. .... 4-123  
Blanchard, Thomas A. .... 6-57  
Bland, Marshall R. .... 6-60  
Bodzin, Jack J. .... 5-103  
Botsco, Ron J. .... 5-113  
Brandon, Ford C. .... 1-103  
Briggs, Daniel D. .... 6-78  
Carnes, Richard C. .... 6-67  
Chandler, Harry E. .... 4-140  
Cormack, W. J. .... 4-122  
Craft, C. Howard ..... 5-79  
Crosbie, James P. .... 4-143  
Dunleavy, Joseph F. .... 5-119  
Egnell, Lennart ..... 3-102  
Enright, Thomas J. .... 1-107  
Ewald, Ferdinand L. .... 4-125; 5-67  
Ferreira, Lawrence E. .... 6-78  
Fields, Davis, Jr. .... 4-120  
Girardi, Daniel J. .... 4-126  
Gray, Allen G. .... 1-71; 2-71; 3-67;  
4-117; 5-55; 6-53  
Hiatt, William C. .... 4-143  
Houser, Gordon W. .... 5-103  
Just, Erwin ..... 2-110  
Kaufman, Jerome W. .... 1-95  
Kovach, Curtis W. .... 1-105  
Lackner, R. J. .... 6-58  
Leitner, Gordon F. .... 6-62  
Lottridge, Neil M. .... 4-121  
Marshall, E. Gary ..... 3-91  
Martin, David B. .... 2-103  
McGowan, Robert D. .... 3-78  
Meigun, Edmund L. .... 4-125  
Merwarth, William R. .... 2-103  
Milano, Nicholas P. .... 4-122  
Mocarski, Stanislaw ..... 3-96  
Moskowitz, Arthur ..... 1-105  
Nelson, Paul G. .... 6-87  
Proctor, Edward S. .... 2-80  
Rauch, A. H. .... 4-126  
Regan, James J. .... 5-113  
Sharp, William R. .... 1-107  
Siegrist, Fred L. .... 1-115; 4-153  
Singleton, Ogle R. .... 3-78  
Spangler, Grant E. .... 3-78  
Sprtnak, Joseph W. .... 5-119  
Sterling, Thomas S. .... 5-84  
Taylor, Donald H. .... 6-63  
Thompson, David S. .... 3-78  
Versaw, W. Dean ..... 4-121  
VerSnyder, Francis ..... 4-124  
Vivian, Gordon ..... 6-61  
Weymueller, Carl R. .... 2-72; 2-107; 4-130; 4-175  
Wiedemann, Chester R. .... 6-66  
Wilson, Charles R. .... 2-75  
Yang, Charles T. .... 5-107